Engineering Tripos Part IIA Project, GD2: Structural Modelling, 2022-23

Leader

Prof A McRobie [1]

Timing and Structure

Group

Prerequisites

3D4 essential

Aims

The aims of the course are to:

- To learn about the design of lightweight building structures, such as tension structures, shells and gridshells.
- To gain fluency with modern parametric design tools.

Content

This project places central focus on design, as may be undertaken in a consultant structural engineering practice. Students will work in small teams to design an innovative lightweight structure to satisy a challenging design brief.

FORMAT

A combination of mini-lectures, design studios and model construction sessions, with self-paced learning of background theory and of applicable computational techniques.

ACTIVITIES

The project will be supported by external speakers who are international experts in their fileds. In particular, guidance will be provided by Bill Baker and Ian Liddell. Bill is the Structural Partner at Skidmore Owings and Merrill in Chicago. Bill has been responsble for the design of many of the world's most iconic buildings, including the 824m Burj Khalifa in Dubai, the world's tallest. Ian was formerly the chief structural designer at Buro Happold in Bath, and is one of the world's leading designers of tension stuctures. In particular, Ian was the structural designer of the London Millennium Dome (now the O2 Arena).

Minilectures will be given by the external experts and by the course leader to explain how to approach the design of long-span lightweight structures of various typologies.

Simplified analytical theory will be presented which will allow design calculations to be made, solving the systems of nonlinear equations via simple Python scripts.

Students will be introduced to modern parametric design software such as Rhino/Grasshopper in which design parameters can be explored and developed.

Students will wortk in small teams to develop their designs.

The final output will be a numerical model of the structural behaviour, a virtual parametric model to showcase the project's architectural features and a physical model for presentation to the client. The scope and scale of the physical model will be governed by whatever COVID restrictions are in place during the project period. Ideally the physical models could have dimensions of several metres, like a small pavilion, but smaller models may be accepted if there are impediments to the creation of larger constructions.

MINI LECTURES

- How to design lightwieght structures: tension structres, gridshells, shells, tensegrity structres, kinetic structures.
- How to use modern parametric design siftware such as Rhino, with its Grasshopper scripting interface.
- Basics of physical model building

Coursework

Coursework
Preliminary design report Final design report Client presentation and physical model

Examination Guidelines

Please refer to Form & conduct of the examinations [2].

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Links
[1] mailto:fam20@cam.ac.uk
[2] https://teaching24-25.eng.cam.ac.uk/content/form-conduct-examinations